RÉSEAU BIOFUELNET CANADA

PROJECT PROMOTES PELLET PRODUCTION

While "dense" may not be a quality coveted by humans, it has distinct advantages when it comes to biomass. Identifying and achieving those benefits were critical goals of the project "**Application of thermo-chemical and hydrothermal pretreatments in the production of fuel pellets using agricultural wastes**".

"Densification or pelletization **increases biomass density by 4-10 times** over untreated biomass, which **reduces transportation costs** and **storage space** thanks to convenient material handling and less biomass dust formation," said Dr. Ajay K. Dalai. Dr Dalai is Distinguished Professor of Chemical Engineering and Canada Research Chair in Bioenergy and Environmentally Friendly Chemical Processing, Department of Chemical and Biological Engineering, College of Engineering at the University of Saskatchewan.

The accumulation of biomass dust on machinery and hot surfaces can be a leading cause of fire hazards. Moreover, the densification of biomass into biomass fuel pellets makes the material more uniformly shaped for easy handling, which can be directly used for thermochemical processes such as combustion, gasification, pyrolysis (a process of chemically decomposing organic materials at elevated temperatures in the absence of oxygen) or co-firing with coal.

"The **torrefaction of biomass** before densification can have many **economic benefits** as well [torrefaction is a thermal process to convert biomass into a coal-like material, which has better fuel characteristics than the original biomass. Torrefied biomass is more brittle, making grinding easier and less energy intensive]. **Torrefaction aids** in the reduction of moisture content, enhancement of carbon content and heating values, volume reduction and increases in bulk density. All these properties are **advantageous** for the long-term storage and transportation of biomass or its fuel pellets while preventing microbial decomposition due to the loss of moisture from biomass."

In this study, torrefaction was performed for three agricultural biomasses – **canola meal, canola hull** and **oat hull** - found predominantly in Saskatchewan, using a fixed-bed reactor as well as a microwave reactor. The effects of temperature and reaction time on biomass torrefaction were investigated. The advanced characterization of torrefied materials was performed at the Saskatchewan Structural Sciences Centre and the Canadian Light Source.

Ms. Tumpa Sarker (Ph.D. student) is working on biomass pellets in the lab

"It was determined that severe torrefaction conditions (i.e. high temperature and longer reaction time) increased the heating value of the torrefied product, yet significantly reduced its yield," said Dr. Dalai. "However, the energy density and carbon content of the torrefied material increased. We found that **temperature plays a pivotal role in regard to reaction time**, **energy density** and **yield** of the torrefied product."

As is clear from this project, the production of value-added products from low-value agricultural feedstocks or by-products obtained after their processing **can be profitable** for the agriculture industry, biorefineries (refineries that convert biomass to energy and other beneficial byproducts such as chemicals) and the Canadian bioeconomy.

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Biomass fuel pellet

Torrefied biomass fuel pellet

In Saskatchewan, there are different types of biomass including **canola meal, canola hull** and **oat hull**, which can be ideal candidates as a precursor for the production of fuel pellets.

"This project could **benefit other stakeholders** such as canola hull and canola meal producers in the province of Saskatchewan by creating a new avenue for **utilizing excessive agricultural crop wastes** obtained from their farms and processes. These abundant agricultural feedstocks can be converted to fuel pellets, which have a **wide range of applications in the power industry as fuel**."

These bio-based fuel pellets are produced from waste biomass, which are renewable energy resources with the potential to reduce carbon emissions when compared to fossil fuels. This project aims to enhance economic growth at both the provincial and national level through agricultural waste utilization to produce fuel pellets for meeting Canada's growing energy demands, as well as for export to other countries. Considering the environmental benefits of fuel pellets and economic growth resulting from their industrial applications, the project can result in **more expansion**, **competitiveness**, and **sustainability** of the Canadian agricultural sector.

"Biomass residue is one of the **most promising energy resources** for meeting the demands of the growing economy," said Dr. Dalai. "The agricultural wastes are renewable energy resources that can reduce carbon emission when compared to fossil fuels. The production of biomass fuel pellets from cheap and abundant agricultural wastes **increases the profitability** of agro-industries, **reduces waste generation** and **has positive impacts on the provincial and rural economy**."

Given the ambitious goals of the project, Dr. Dalai felt it only right to recognize the **people**, the **funding agency** and **industry partner** that made it possible. This project is being executed by a diverse team of researchers including **Ms. Tumpa R. Sarker** (PhD student), **Mr Jude A. Okolie** (PhD student), **Ms. Jennifer Anno-Kusi** (M.Eng.student), **Mr. Ravi Patel** (M.Eng. student) and **Dr. Sonil Nanda** (research associate). Dr. Dalai is grateful to **Biomass Canada Cluster**, **Agriculture and Agri-Food Canada**, and their industry partners **Hey Hey Holdings Inc**. (Ottawa) and **Proveta Nutrition Ltd.** (Saskatoon). The total value of the Biomass Canada Cluster is **$12.3 million over 5 years** (2018-2023), with funds from both AAFC and industry partners ($4 million).

For more information on this project, please contact:

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